

Amendments to the Claims

This listing of claims will replace all prior versions, and listings, of claims in the application.

1-2. (Canceled)

3. (Currently amended) [[A]] An imaging system for an open surgical procedure, the imaging system comprising:

~~an enclosure for a surgical procedure that excludes broadband light sources, thereby providing an operating area closed to ambient light, the operating area including a surgical field where an open surgical procedure may be performed on a subject;~~

~~a visible light source capable of illuminating the to illuminate a surgical field of a patient's body, the surgical field being exposed during the open surgical procedure, the visible light source providing a range of wavelengths including one or more wavelengths of visible light; and the visible light source further capable of providing conventional lighting for the surgical field;~~

~~an excitation light source capable of illuminating to illuminate the surgical field, the excitation light source including at least one wavelength outside the range of wavelengths of the visible light;~~

~~a fluorescent substance suitable for in vivo use, the fluorescent substance fluorescing at an emission wavelength in response to the at least one wavelength of the excitation light source, the fluorescent substance being introduced into the surgical field;~~

a lens disposed outside of the patient's body so as to receive at least a portion of reflected visible light from the surgical field and at least a portion of a fluorescence emission from the surgical field, the reflected visible light and the fluorescence emission propagating through free space outside of the patient's body from the surgical field to the lens, the lens providing focused reflected visible light and a focused fluorescence emission;

[[an]] at least one electronic imaging device positioned with respect to the lens so as to capture a visible light image of the surgical field based on the focused reflected visible light, and

~~[[an]] a fluorescence emission wavelength image of the surgical field based on the focused fluorescence emission, the electronic imaging device including a lens that provides for manual or automatic control of a focus of light received from the surgical field; and~~

a display that renders a visual representation of the visible light image of the surgical field and the fluorescence emission wavelength image of the surgical field, ~~the emission wavelength image being displayed at a visible light wavelength.~~

4. (Canceled)

5. (Currently amended) The system of claim 3 wherein the one or more wavelengths of visible light from the visible light source does not include far-red light, and wherein at least one of the at least one wavelength of the excitation light source and the emission wavelength includes a far-red light wavelength.

6. (Canceled)

7. (Currently amended) The system of claim 3 further comprising a filter that separates the focused fluorescence emission wavelength from ~~the range of wavelengths from the focused reflected~~ visible light source, the focused fluorescence emission wavelength being directed toward a first optical transducer of the at least one electronic imaging device and ~~the range of wavelengths from the focused reflected~~ visible light source being directed toward a second optical transducer of the at least one electronic imaging device.

8. (Previously presented) The system of claim 7 wherein the second optical transducer separately senses at least each one of red, green, and blue light intensities.

9. (Previously presented) The system of claim 7 wherein the second optical transducer separately senses at least each one of cyan, magenta, and yellow light intensities.

10. (Currently amended) The system of claim 7 wherein the filter includes a dichroic mirror that reflects the focused fluorescence emission ~~wavelength~~ and transmits ~~the one or more wavelengths of visible light from the~~ focused reflected visible light ~~source~~.

11. (Currently amended) The system of claim 7 wherein the filter includes a dichroic mirror that reflects ~~the one or more wavelengths of visible light from the~~ focused reflected visible light ~~source~~ and transmits the focused fluorescence emission wavelength.

12. (Currently amended) The system of claim 7 further comprising a second filter that shapes ~~the wavelengths of the~~ focused reflected visible light ~~source~~.

13. (Currently amended) The system of claim 3 wherein the at least one electronic imaging device includes at least one charge-coupled device.

14. (Currently amended) The system claim 3 wherein the at least one electronic imaging device includes a video camera sensitive to the visible light.

15. (Currently amended) The system of claim 3 wherein the at least one electronic imaging device includes an emission wavelength camera.

16. (Currently amended) The system of claim 3 ~~wherein the electronic imaging device captures a visible light image and an emission wavelength image, the system~~ further comprising a processor that converts the fluorescence emission ~~wavelength~~ image to a converted image having one or more visible light components, and combines the converted image with the visible light image for display.

17. (Currently amended) The system of claim 3 ~~wherein the electronic imaging device captures a visible light image and an emission wavelength image, the system further comprising a processor that converts the fluorescence emission wavelength image to a converted image having one or more visible light components, and superimposes the converted image onto the visible light image for display.~~

18. (Currently amended) The system of claim 3 ~~wherein the electronic imaging device captures a visible light image and an emission wavelength image, and wherein the visible light image is captured at thirty frames per second and the fluorescence emission wavelength image is captured at fifteen frames per second, the fluorescence emission wavelength image being converted to thirty frames per second for combination with the visible light image.~~

19. (Currently amended) The system of claim 3 ~~wherein the electronic imaging device captures a visible light image and an emission wavelength image, and wherein the visible light image is captured at thirty frames per second and the fluorescence emission wavelength image is captured at fifteen frames per second, the visible light image being converted to fifteen frames per second for combination with the fluorescence emission wavelength image.~~

20. (Previously presented) The system of claim 3 wherein the excitation light source includes a laser.

21 - 28. (Canceled)

29. (Currently amended) The system of claim 3 wherein ~~the display includes a surgical microscope;~~

the imaging system includes a surgical microscope; and

the display is constituted by a monocular or binocular eyepiece of the surgical microscope.

30. – 33. (Canceled).

34. (Currently Amended) A method for imaging an open surgical procedure, the method comprising:

~~enclosing a subject of an open surgical procedure in an operating area closed to ambient light to exclude broadband light sources from the operating area;~~

A) illuminating the subject a surgical field of a patient's body with one or more wavelengths of visible light, the surgical field being exposed during the open surgical procedure;

B) concurrently illuminating the subject surgical field with [[an]] at least one excitation wavelength that is not one of the one or more wavelengths of visible light;

C) introducing a fluorescent substance into the subject patient's body, the fluorescent substance emitting photons a fluorescence emission including at [[an]] least one emission wavelength in response to the at least one excitation wavelength;

~~automatically or manually controlling a focus of a lens that receives light from the subject;~~

D) receiving, at a lens disposed outside of the patient's body, at least a portion of reflected visible light from the surgical field and at least a portion of the fluorescence emission from the surgical field, the reflected visible light and the fluorescence emission propagating through free space outside of the patient's body from the surgical field to the lens, the lens providing focused reflected visible light and a focused fluorescence emission;

E) electronically capturing a visible light image of the subject from the lens surgical field based on the focused reflected visible light;

F) electronically capturing [[an]] a fluorescence emission wavelength image of the subject surgical field based on the focused fluorescence emission; and

G) displaying concurrently on a display device the visible light image and the fluorescence emission wavelength image.

35-38. (Canceled)

39. (New) The method of claim 34, wherein the surgical field includes a lesion, and wherein the fluorescent substance introduced in C) labels at least one of an antibody, an antibody fragment, and a low-molecular-weight ligand that accumulates at the lesion.

40. (New) The method of claim 34, wherein the surgical field includes at least a portion of the patient's circulatory system, wherein the fluorescent substance introduced in C) is soluble in blood, and wherein in F) and G), the fluorescence emission image includes a blood flow visualization of the portion of the patient's circulatory system in the surgical field.

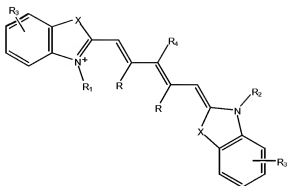
41. (New) The method of claim 34, wherein the fluorescent substance includes a fluorescent dye, and wherein C) comprises injecting the fluorescent dye into the patient's body by an intravenous injection.

42. (New) The method of claim 34, wherein C) comprises spraying the fluorescent substance onto the surgical field.

43. (New) The method of claim 34, wherein in C), the fluorescent substance includes one or more quantum dots.

44. (New) The method of claim 34, wherein in C), the fluorescent substance includes at least one of indocyanine green, fluorescein, methylene blue, and IRDye78-CA.

45. (New) The method of claim 34, wherein in C), the fluorescent substance is a dye having a structure of the formula:



wherein, as valence and stability permit,

X represents C(R)₂, S, Se, O, or NR₅;

R represents H or lower alkyl, or two occurrences of R, taken together, form a ring together with the carbon atoms through which they are connected;

R₁ and R₂ represent, independently, substituted or unsubstituted lower alkyl, lower alkenyl, cycloalkyl, cycloalkylalkyl, aryl, or aralkyl;

R₃ represents, independently for each occurrence, one or more substituents to the ring to which it is attached;

R₄ represents H, halogen, or a substituted or unsubstituted ether or thioether of phenol or thiophenol; and

R₅ represents, independently for each occurrence, substituted or unsubstituted lower alkyl, cycloalkyl, cycloalkylalkyl, aryl, or aralkyl.

46. (New) The imaging system of claim 3, wherein the visible light source further provides conventional lighting for the open surgical procedure.

47. (New) The imaging system of claim 3, further comprising at least one of a hood, an enclosure, and a covering to provide an operating area for the open surgical procedure, wherein the operating area is closed to ambient light by the at least one of the hood, the enclosure and the covering.